



First record of *Leptodactylus sertanejo* (Anura: Leptodactylidae: Leptodactylinae) in the state of Maranhão, northeastern Brazil

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Abstract: *Leptodactylus sertanejo* is a mid-sized frog that inhabits areas of the Cerrado Biome, in natural and artificial grassland areas, in the states of Minas Gerais, São Paulo, Bahia, Goiás and Tocantins, Brazil. Herein, we provide the first species record for the state of Maranhão, northeastern Brazil, expanding the known distribution of *L. sertanejo* ca. 420 km northeast from the Parque Estadual do Jalapão, Tocantins state.

Key words: *Leptodactylus fuscus* species group, Alpercatas/Itapecuru River basin, Parque Estadual do Mirador, geographic distribution map

The Neotropical genus *Leptodactylus* Fitzinger, 1826, widely distributed in South America (Frost 2015), comprises 74 species currently (de Sá et al. 2014) divided into four species groups: *L. fuscus* group, *L. latrans* group, *L. pentadactylus* group, *L. melanonotus* group, except for three species [*L. hylodes* (Reinhardt & Lütken, 1862), *L. lauramiriamae* Heyer & Crombie, 2005, *L. ochraceus* Lutz, 1930] that were not placed in any species group (*sensu* de Sá et al. 2014). The *L. fuscus* species group is the most speciose group in the genus, comprising 28 species (Carvalho et al. 2013; de Sá et al. 2014), including *L. sertanejo* Giaretta and Costa, 2007.

Leptodactylus sertanejo, an endemic species of the Cerrado Biome, was described in 2007 from one population occurring in the Cerrado of southeastern Brazil (municipality of Uberlândia, state of Minas Gerais) previously recognized as *L. jolyi* Sazima and Bokermann, 1978 (Giaretta and Costa 2007). Herein, we present the first record of *L. sertanejo* from the state of Maranhão, northeastern Brazil.

Fieldwork was conducted in February 2014. We recorded several individuals of *L. sertanejo* (Figure 1) calling between 18:00 h to 21:00 h at the Parque Estadual do Mirador (06°47'28.20" S, 045°28'25.10" W, datum SAD69), in southern Maranhão. Individuals were identified by their morphological characteristics and advertisement call features. The Parque Estadual do Mirador, an important Conservation Unit for the state, comprises the municipalities of Mirador, Grajaú, and São Raimundo das Mangabeiras, and is geographically located between the sources of the rivers Itapecuru and Alpercatas. This Conservation Unit presents typical vegetation of the Cerrado biome (Conceição and Castro 2009), with local climate ranging from sub-humid to humid (IBGE 1998).

The call of an adult male was recorded and analyzed to confirm the species identification. We used a digital recorder (Marantz PMD660) coupled to a directional microphone (Sennheiser Me66/K6) with sampling rate of 44.1 kHz and a 16-bit resolution. The oscillogram and audiospectrogram were generated using the software Soundruler version 0.9.6 (Bee 2004; Gridi-Papp 2004). Only one adult male was collected (Figure 1) and deposited in the Coleção Zoológica Delta do Parnaíba-CZDP, Universidade Federal do Piauí-UFPI (CZDP (I1) 0456). The collecting permit (license number 008/2013) was provided by Secretaria de Estado do Meio Ambiente e Recursos Naturais do Maranhão (SEMA-MA).

The specimens were found calling under dense vegetation in a flooded field, called veredas, covered by emergent vegetation (Figure 1). According to its original description (Giaretta and Costa 2007), *L. sertanejo* is more similar to *L. gracilis* (Duméril and Bibron, 1840),



Figure 1. Left: An adult male of *Leptodactylus sertanejo* from Parque Estadual do Mirador, Maranhão, northeastern Brazil. Right: Habitat where the individual was collected.

L. jolyi, *L. marambaiae* Izecksohn, 1976, and *L. plaumanni* Ahl, 1936 by presenting longitudinal skin folds on the dorsal surface of the shanks, and is distinguished by its moderate size and its call (Giaretta and Costa 2007; de Sá et al. 2014). The specimen was diagnosed by its snout-vent length (SVL) of 51 mm and by its advertisement call (Figure 2) non-pulsed with dominant frequency varying from 2153–2325 Hz (mean 2325 Hz; SD = 84.05), emitted at rates of 1–16 calls/minute. Call duration varies from 17.48–22.97 ms (mean 20.11 ms; SD = 1.52; $n = 15$ notes), separated by internote intervals varying between 422.4 and 7095 ms (mean 2535 ms; SD = 2025; $n = 15$ notes).

The advertisement call of *L. sertanejo* is quite similar to that of *L. jolyi*. However, the latter has a longer call, consisting of 1–3 pulses, while *L. sertanejo* has a single or double pulsed vocalization (Giaretta and Costa 2007). Thus,

the results presented here confirm the identity of species.

Leptodactylus sertanejo occurs in natural and artificial grassland areas of the Cerrado (Brasileiro et al. 2005; Giaretta and Costa 2007; Valdujo et al. 2009; Kopp et al. 2010; Valdujo et al. 2011; Melo et al. 2013; Santoro and Brandão 2014). Its real distribution could be underestimated due to the nomenclatural problem associated with the names *L. sertanejo* and *L. jolyi*. After the description of *L. sertanejo*, the species recorded in the Cerrado domain previously treated as *L. jolyi* (Haddad et al. 1988; Brasileiro et al. 2005; Uetanabaro et al. 2007) were considered as *L. sertanejo* (Giaretta and Costa 2007). Subsequent studies also reported the occurrence of *L. sertanejo* in the Estação Ecológica Serra Geral do Tocantins, state of Tocantins (Valdujo et al. 2011), in the Parque Nacional das Emas (Kopp et al. 2010), Reserva Extrativista Lago do Cedro (Melo et al. 2013), Alto Paraíso de Goiás (Carvalho et al. 2013) and Parque Nacional Chapada dos Veadeiros, in the state of Goiás, central Brazil (Santoro and Brandão 2014), and in the municipality of São Roque de Minas in Minas Gerais state (Carvalho et al. 2013). However, some authors cite *L. jolyi* for Cerrado formations (e.g. Araújo et al. 2009; São Pedro and Feio 2011). Araújo et al. (2009) provide a list of amphibian species of São Paulo including *L. sertanejo*. São-Pedro and Feio (2011) report the species from the municipality of Ouro Branco, an area of Atlantic Forest in Minas Gerais state. Araújo et al. (2013), recorded *L. sertanejo* in basins of the Paranapanema River, São Paulo, an area of Atlantic Forest. This reveals the need for future revisions regarding *L. sertanejo* and *L. jolyi*.

Most of the records of *L. sertanejo* were made in the southern and central regions of Brazil. However, Valdujo et al. (2009) reported the first record of this

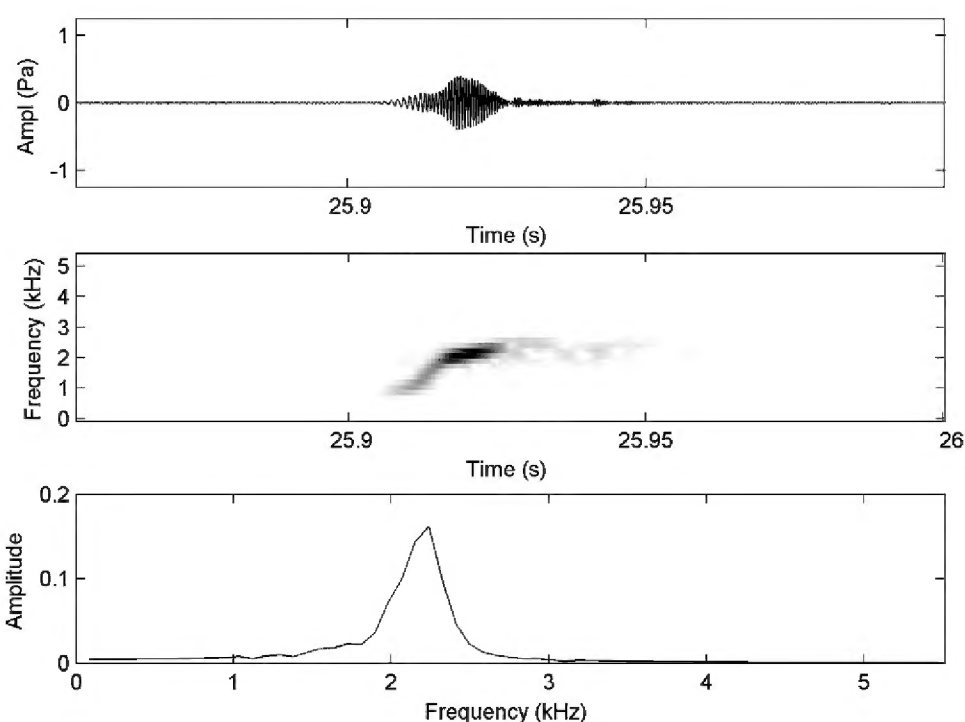


Figure 2. Advertisement call of *Leptodactylus sertanejo* from Parque Estadual do Mirador, Maranhão, northeastern Brazil. From top to bottom: waveform, spectrogram, and power spectrum of a single note.

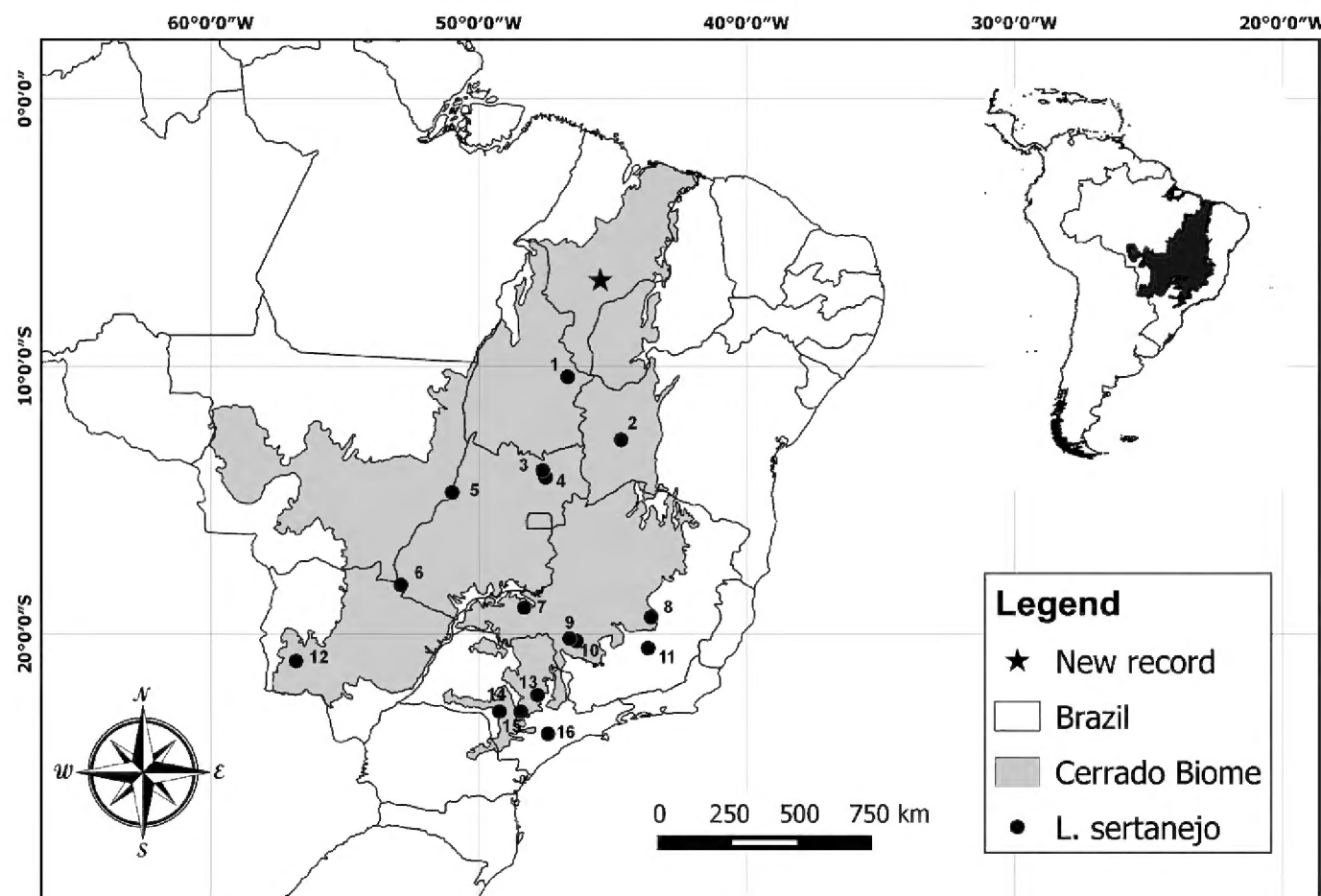


Figure 3. Geographic distribution of *Leptodactylus sertanejo* in the Brazilian Cerrado Biome. Black star represents the new record for the state of Maranhão. Black circles represent the literature records: 1 - Estação Ecológica Serra Geral do Tocantins (Valdujo et al. 2011); 2 - São Desidério (Valdujo et al. 2009); 3 - Parque Nacional Chapada dos Veadeiros (Santoro and Brandão 2014); 4 - Alto Paraíso de Goiás (Carvalho et al. 2013); 5 - Reserva Extrativista Lago do Cedro (Melo et al. 2013); 6 - Parque Nacional da Emas (Kopp et al. 2010); 7 - Uberlândia (Giaretta and Costa 2007); 8 - Parque Nacional da Serra do Cipó (Sazima and Bokermann 1978); 9 - Parque Nacional da Serra da Canastra (Haddad et al. 1988); 10 - São Roque de Minas (Carvalho et al. 2013); 11 - Ouro Branco (São-Pedro and Feio 2011); 12 - Parque Nacional da Serra da Bodoquena (Uetanabaro et al. 2007); 13 - Estação Ecológica de Itirapina (Brasileiro et al. 2005); 14 - Águas de Santa Bárbara; 15 - Botucatu; e 16 - Piedade (Araújo et al. 2013).

species outside these regions, in a study to determine the amphibian diversity of Cerrado, in the eastern part the municipality of São Desidério, state of Bahia. Herein, we present the first record this species in the state of Maranhão, northeastern Brazil (Figure 3), extending its distribution about 600 km northwest from the municipality of São Desidério, state of Bahia (Valdujo et al. 2009) and about 420 km northeast from the Parque Estadual do Jalapão, state of Tocantins (Valdujo et al. 2011).

This new record represents the northernmost occurrence of *L. sertanejo*, indicating that this species could be distributed along a diagonal corridor formed by wetlands in the Cerrado from Mato Grosso do Sul to southern Maranhão. The record of *L. sertanejo* in southern Maranhão emphasizes the importance of conducting more inventory studies in this region (Araújo et al. 2015), since the knowledge of fauna, including amphibians, is fundamental for the implementation of environmental conservation measures. Parque Estadual do Mirador is an extremely important Conservation Unit inserted into the Polo Agrícola South of Maranhão, and has constantly been threatened by advances of agricultural activities in the region.

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LITERATURE CITED

- Araújo, K.C., M.V. Santos, T.G.P. Lima, E.B. Andrade and L.N. Weber. 2015. First record of *Adenomera saci* Carvalho & Giaretta, 2013 (Anura: Leptodactylidae) for the state of Maranhão, Northeastern Brazil. *Herpetology Notes* 8: 183–185. <http://www.biotaxa.org/hn/article/view/9742/12634>
- Araujo, C.O., C.K. Matsukuma and S.M. Ameida-Santos. 2013. Taxonomic composition and distribution of anurans in the Upper and Middle Paranapanema, São Paulo state, Brazil. *Biota Neotropica* 13(3): 241–258. <http://www.biotaneotropica.org.br/v13n3/en/abstract?inventory+bno1713032013>
- Araújo, O.G.S., L.F. Toledo, P.C.A. Garcia and C.F.B. Haddad. 2009. The amphibians of São Paulo state, Brazil amphibians of São Paulo. *Biota Neotropica* 9(4): 197–209. <http://www.biotaneotropica.org.br/v9n4/en/abstract?inventory+bno3109042009>
- Bee, M.A. 2004. Sound Ruler acoustical analysis: a free, open code, multi-platform sound analysis and graphing package. *Bioacoustics* 14: 171–178. <http://soundruler.sourceforge.net>
- Brasileiro, C.A., R.J. Sawaya, M.C. Kiefer and M. Martins. 2005. Amphibians of an open Cerrado fragment in southeastern Brazil. *Biota Neotropica* 5(2): 1–17. <http://www.biotaneotropica.org.br/v5n2/pt/abstract?article+BN00405022005>
- Carvalho, T.R., F.S.F. Leite and T.L. Pezzuti. 2013. A new species of *Leptodactylus* Fitzinger (Anura, Leptodactylidae, Leptodactylinae) from montane rock fields of the Chapada Diamantina,

- northeastern Brazil. *Zootaxa* 3701(3): 349–364. doi: 10.11646/zootaxa.3701.3.5
- Conceição, G.M. and A.A.J.F. Castro. 2009. Fitossociologia de uma área de Cerrado Marginal, parque Estadual do Mirador, Mirador, Maranhão. *Scientia Plena* 5(10): 1–16.
- de Sá, R. O., T. Grant, A. Camargo, W. R. Heyer, M. L. Ponssa and E. Stanley. 2014. Systematics of the Neotropical genus *Leptodactylus* Fitzinger, 1826 (Anura: Leptodactylidae): phylogeny, the relevance of non-molecular evidence, and species accounts. *South American Journal of Herpetology*, 9(Special Issue 1): 1–128.
- Frost, D.R. 2015. Amphibian species of the world: an online reference. Version 6.0. American Museum of Natural History, New York. Accessed at <http://research.amnh.org/herpetology/amphibia/index.html>, 27 May 2015.
- Giaretta A.A. and H.C.M. Costa. 2007. A redescription of *Leptodactylus jolyi* Sazima and Bokermann (Anura, Leptodactylidae) and the recognition of a new closely related species. *Zootaxa* 1608: 1–10. <http://www.mapress.com/zootaxa/2007f/z01608p01of.pdf>
- Gridi-Papp, M. 2004. SoundRuler: acoustic analysis for research and teaching. Accessed at <http://soundruler.sourceforge.net>, 20 March 2015.
- Haddad, C.F.B, G.V. Andrade and A.J. Cardoso. 1988. Anfíbios anuros no Parque Nacional da Serra da Canastra, Estado de Minas Gerais. *Brasil Florestal* 64: 9–20.
- IBGE. Instituto Brasileiro de Geografia e Estatística. 1998. Subsídios ao zoneamento ecológicoeconômico da Bacia do Rio Itapecuru – MA: diretrizes gerais para ordenação territorial. Primeira Divisão de Geociência do Nordeste. Rio de Janeiro: IBGE. 187p.
- Kopp, K., L. Signorelli and R.P. Bastos. 2010. Distribuição temporal e diversidade de modos reprodutivos de anfíbios anuros no Parque Nacional das Emas e entorno, estado de Goiás, Brasil. *Iheringia, Série Zoológica* 100(3): 192–20. <http://www.scielo.br/pdf/isz/v100n3/v100n3a02.pdf>
- Melo, M., F. Fava, H.B.A. Pinto, R.P. Bastos and F. Nomura. 2013. Diversidade de Anuros (Amphibia) na reserva extrativista Lago do Cedro e seu entorno, Aruanã, Goiás. *Biota Neotropica* (13)2: 205–217. <http://www.biotaneotropica.org.br/v13n2/en/abstract?inventory+bno2913022013>
- São-Pedro, V.A. and R.N. Feio. 2011. Anuran species composition from Serra do Ouro Branco, southernmost Espinhaço Mountain Range, state of Minas Gerais, Brazil. *Check List* 7(5): 671–680. <http://www.checklist.org.br/getpdf?SL020-11>
- Santoro, G.R.C.C. and R.A. Brandão. 2014. Reproductive modes, habitat use, and richness of anurans from Chapada dos Veadeiros, central Brazil. *North-Western Journal of Zoology* 10(2): 365–373. http://biozoojournals.ro/nwjz/content/v10n2/nwjz_141505_Santoro.pdf
- Uetanabaro, M, F.L. Souza, P. Landgraf Filho, A.F. Beda, and R.A. Brandão. 2007. Amphibians and reptiles of the Serra da Bodoquena National Park, Mato Grosso do Sul, central Brazil. *Biota Neotropica* 7(3): 279–289. <http://www.biotaneotropica.org.br/v7n3/pt/abstract?Inventory+bno1207032007>
- Valdujo, P.H., A. Camacho, R.S. Recoder, M. Teixeira Junior, J.M.B. Ghellere, T. Mott, P.M.S. Nunes, C. Nogueira and M.T. Rodrigues. 2011. Anfíbios da Estação Ecológica Serra Geral do Tocantins, região do Jalapão, estados do Tocantins e Bahia. *Biota Neotropica* 11(1): 251–261. <http://www.biotaneotropica.org.br/v11n1/en/abstract?article+bno3511012011>.
- Valdujo, P.H., R.S. Recoder, M.M. Vasconcellos and A.S. Portella. 2009. Amphibia, Anura, São Desidério, western Bahia uplands, northeastern Brazil. *Check List* 5(4): 903–911. <http://www.checklist.org.br/getpdf?SL030-09>

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